July 19th , 2012 / Marco Leicht , Annitor

EV Charging infrastructure
Intelligent charging solutions

Power and productivity
for a better world™ **ABB**

Proposal for Agenda
To be fixed

- Introduction participants / Fixation agenda

- Status and plans customer
  - Status
  - Plans for near future
  - What are the topics customer is especially interested in

- Status and plans ABB

- Way forward / open points

- Action points & Follow-up

EV Charging Infrastructure product group
Organization, scope, references

EV Charging Infrastructure
Product portfolio overview

Terra

DC fast chargers

Web connected intelligent DC fast charging systems

Terra

AC chargers & charge clusters

Turnkey solutions of AC and DC charging systems

Galaxy

EV infrastructure management tools

Web-based services for site management, statistics and configuration

Galaxy

Integration services

Professional back office integration services

Why ABB?
Solutions for the whole EV charging value chain

DC Fast Chargers
- Terra systems

Energy storage
- B.E.S.S.

Power Quality
- PQF, PCS100

Substations
- Power systems

AC Chargers
- AC charger range

ABB's future-proof solutions will work together seamlessly throughout the whole value chain

Grid Automation
- SCADA & Ventyx

Charging Network Software Services
- Galaxy services

Building Automation
- KNX, energy mngt.

Components
- DIN rail & distribution boards

Renewable Integration
- HVDC, solar, wind

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ABB DC fast charge installations
Proven technology in the field since May 2010

- **Actual:**
  Germany, Norway, The Netherlands, UK, Ireland, Finland, Denmark, Sweden, Switzerland, Austria, France, Czech, Estonia, Turkey, Hungary, Italy, Hong Kong, Chile, China, USA, Taiwan, Slovenia, South Africa.

- **Expected soon:**
  Belgium, Bulgaria, Singapore

Highlighted project: ABB - BP cooperation
Proven technology in the field since May 2010

- ABB & BP roll out a network of DC fast chargers at BP petrol stations in EU

- First 5 locations in Benelux

- ABB to deliver hardware, maintenance services, connectivity and back office integration services to payment systems

- ABB certified to install at petrol sites

Project Estonia: Country wide network
ABB awarded Europe's largest EV infrastructure project

- ABB awarded Europe's largest ever EV infrastructure deployment

- Nationwide network: every main road in Estonia will have a fast charger approximately every 50 km

- ABB manages full turnkey project

- Completed in Q4, 2012

200 DC + AC combined fast chargers

507 AC chargers at office locations

Turnkey project & network services

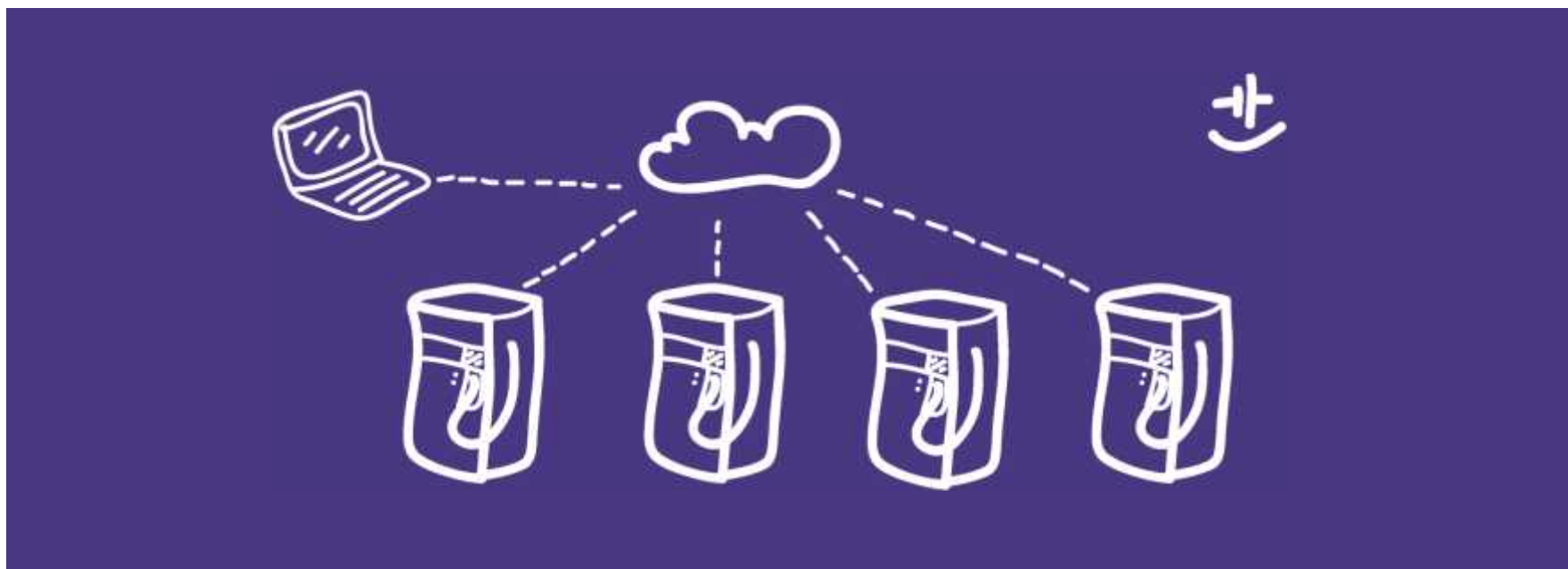# Installations in Italy
ABB Sesto San Giovanni

Installations in Italy
ABB Dalmine, Peugeot Milano, Eurocities 2011 Genova

EV Charging Infrastructure product group
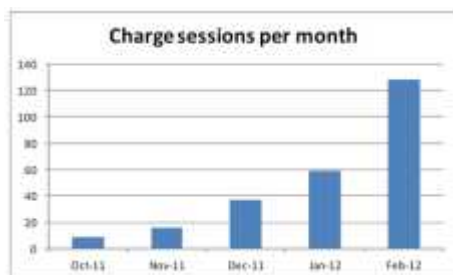## Business model / locations

Why invest in DC fast chargers?
The business case based on real life data from the field

Business case: DC fast chargers in the Netherlands

- Network of 23 DC Fast chargers installed in 2011

- In total 550 DC fast chargeable CHAdeMO cars on road in 2011

Charge sessions per month

Charger #1

- Start: 0,3 sessions/ day

- Q1 2012: 4 sessions / day

Charger #2

- Start: 1 session / day

- Q1 2012: 8 sessions / day

Operators charge €6 per session, the electricity cost of a session is approximately €2

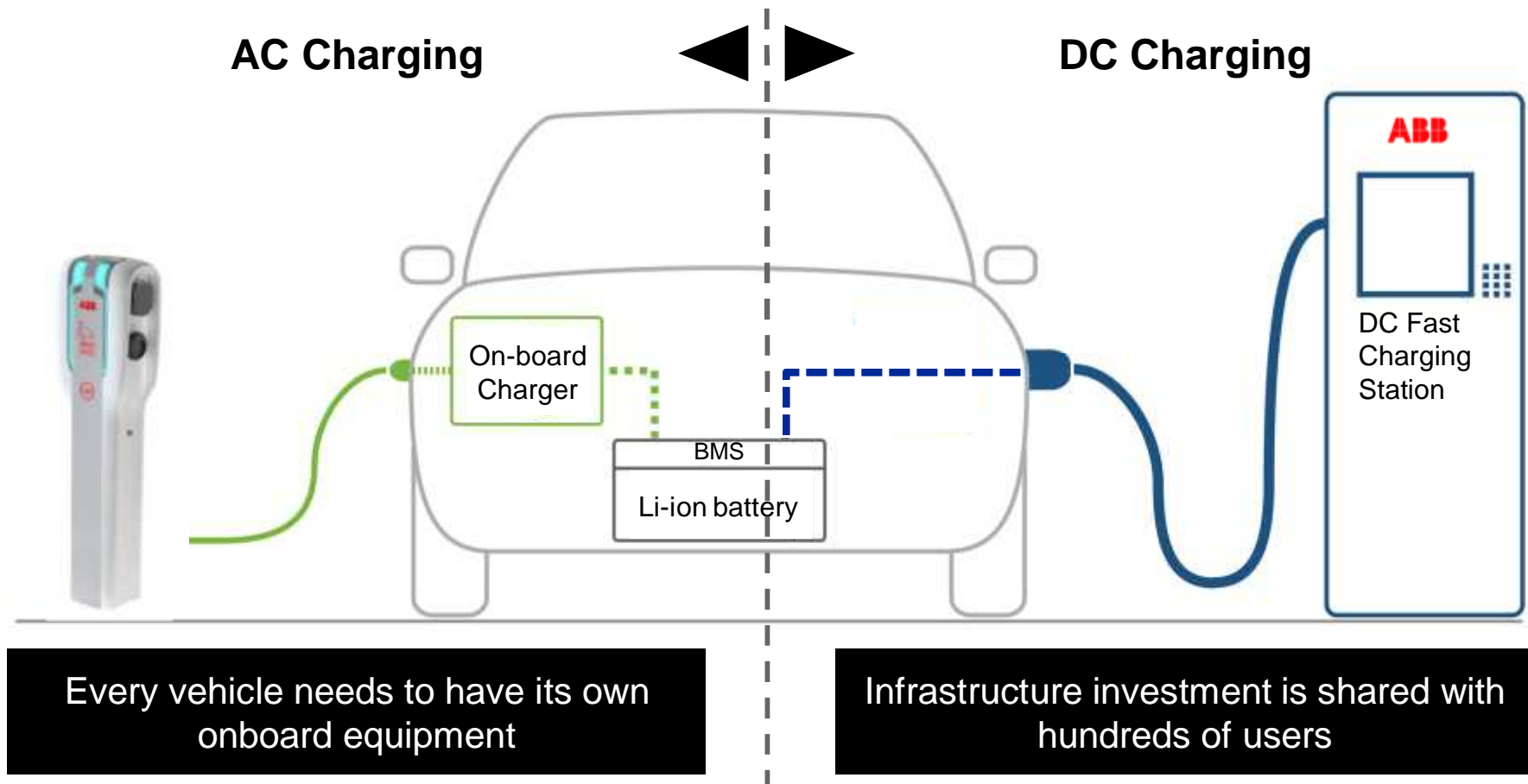| Charger	Sessions per day jan. 2012	Price per session to consumer	Revenue/ year	Profit/year
#1	4	€6	€ 8.760	**€ 5.840**
#2	8	€6	€ 17.520	**€ 11.680**

EV Charging Infrastructure product group
Market (cars & standards)

DC charging versus AC charging
On-board versus Off-board equipment

AC Charging

◄ ►

DC Charging

On-board Charger

BMS

Li-ion battery

DC Fast Charging Station

ABB

Every vehicle needs to have its own onboard equipment

Infrastructure investment is shared with hundreds of users

DC charging extends the range
The major part of charging will be Slow Charging

EV Slow Charging
- 16 hours
- 100 km

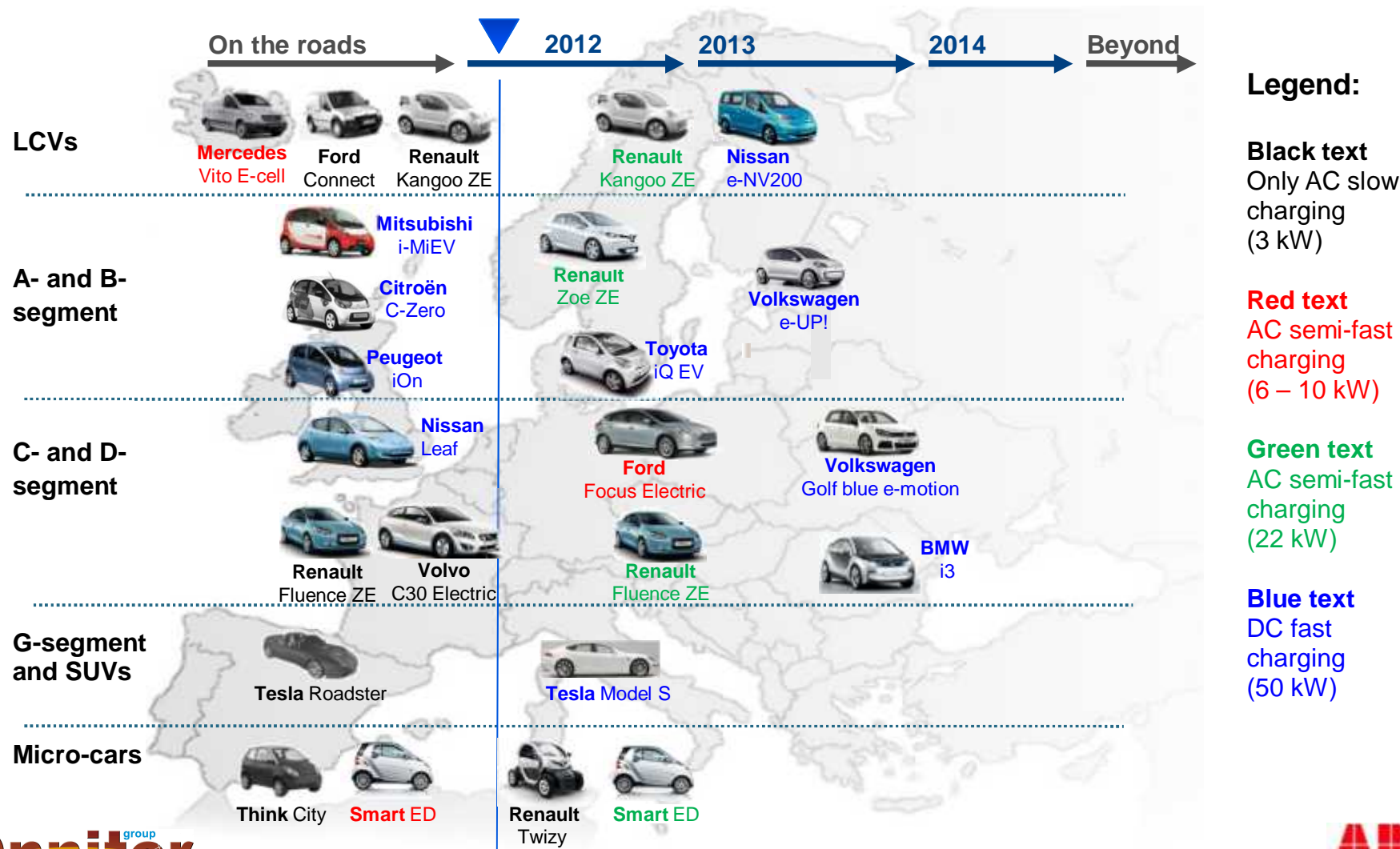**Slow Charging and Ultra Fast Charging**
- 15 hours
- 300 km

EV Ultra Fast Charging
- 22,5 hours
- 300 km

The landscape of EV's and (fast) charge capabilities in Europe in the next years

On the roads → **2012** → **2013** → **2014** → **Beyond**

LCVs
- Mercedes Vito E-cell
- Ford Connect
- Renault Kangoo ZE
- Renault Kangoo ZE (2012)
- Nissan e-NV200 (2013)

A- and B-segment
- Mitsubishi i-MiEV
- Citroën C-Zero
- Peugeot iOn
- Renault Zoe ZE (2012)
- Toyota iQ EV (2012)
- Volkswagen e-UP! (2013)

C- and D-segment
- Nissan Leaf
- Renault Fluence ZE
- Volvo C30 Electric
- Ford Focus Electric (2012)
- Renault Fluence ZE (2012)
- Volkswagen Golf blue e-motion (2013)
- BMW i3 (2014)

G-segment and SUVs
- Tesla Roadster
- Tesla Model S (2012)

Micro-cars
- Think City
- Smart ED
- Renault Twizy (2012)
- Smart ED (2012)

Legend:

Black text
Only AC slow charging (3 kW)

Red text
AC semi-fast charging (6 – 10 kW)

Green text
AC semi-fast charging (22 kW)

Blue text
DC fast charging (50 kW)

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Electric vehicle charging infrastructure
Market segments & products

Use cases in electric vehicle charging
Different solutions for each specific use case

Highway
- DC fast charging
- 15-30 minutes

Commercial
- DC & AC charging
- 30-120 min.

Office
- AC & DC charging
- 30-120 min. (fast)
- 8 hours (workday)

Home
- AC & DC charging
- 8 hours (overnight)
- 2 hours (top-off)

Overview of the product categories in EV charging
A solution for any use case

DC + AC Highway Charger	DC + AC Commercial Charger	AC Charge Pole	AC Wall-box
▪ > 50 kW	▪ 20 kW	▪ 3-10 kW	▪ 3-6 kW
▪ 15-30 min. use case	▪ 30-120 min. case	▪ 4-8 h. use case	▪ 4-8 h. use case

Overview of DC Chargers
A solution for any use case

Dual DC Highway Charger	DC + AC Highway Charger	DC Highway Charger	DC + AC Commercial Charger
• 2x 50kW DC	▪ 50kW DC+22kW AC	▪ 50kW DC	▪ 20kW DC
• 15-30 min.	▪ 15-30 min.	▪ 15-30 min.	▪ 30-120 min.

Terra 51 & 100.2 series
Powerful fast charging performance for highway locations

Use cases in electric vehicle charging
ABB products for the highway use case

Highway
- DC fast charging
- 15-30 minutes

Commercial
- DC & AC charging
- 30-120 min.

Office
- AC & DC charging
- 30-120 min. (fast)
- 8 hours (workday)

Home
- AC & DC charging
- 8 hours (overnight)
- 2 hours (top-off)

Terra 51 Charge Station
The powerful DC fast charger for highway locations

- Intelligent web-connected DC charger
- 15-30 minutes charge time
- Ultra silent in operation

Product	Terra 51			
AC Input	3Φ, 400 VAC ± 10%			
Maximum output power	DC	50kW		
Output voltage		50-500 V		
Output current		120A		
Efficiency	> 92%			
Power factor	> 0,98			
RFID system	13,56MHz, ISO 14443A			
Communication	CDMA / 3G / Ethernet			
Protection class	IP54			
Temperature range	-30°C … +45 °C, with low-temp option			
Software	Remote update / download			
User interface	High brightness full colour LCD, Start/Stop & Emergency stop			

Terra 51 Charge Station
Highlighted smart features

Web-connected intelligent charging

- Web connection via Ethernet / GSM / CDMA
- Robust Linux OS platform
- Remote software updates

DC output metering

- Measure delivered kWh at the DC output
- Remote read-out via web / OCPP

Optional smart power limiting system

- Limiting input power up to 3x64A can help to avoid power peaks & high installation costs

Optional MiD certified smart kWh metering

- Measure the AC power consumption of the charger for sub-metering or host billing purposes
- Remote read-out via web / OCPP

Terra 51 Charge Station with AC
Fast charge all AC and DC cars on the road today

- Compatible with AC and DC cars
- 50kW DC & 22 kW AC
- Smart power sharing between AC and DC
- Automatic switching between 16A & 32A AC

Product	Terra 51+AC			
AC Input	3Φ, 400 VAC ± 10%			
Maximum output power	DC	50kW	AC	11/22kW
Output voltage		50-500 V		400 VAC
Output current		120A		3 x16 A/ 3 x 32A
Efficiency	> 92%			
Power factor	> 0,98			
RFID system	13,56MHz, ISO 14443A			
Communication	CDMA / 3G / Ethernet			
Protection class	IP54			
Temperature range	-30°C … +45 °C, with low-temp option			
Software	Remote update / download			
User interface	High brightness full colour LCD, Start/Stop & Emergency stop			

Terra 100.2 solution
Multiple outlets with a remote power system

- Intelligent web-connected multi-port DC charger
- 15-30 minutes charge time
- Remote power system can be installed out of sight

Product	Terra 100.2 with Charge Post		
AC Input	3Φ, 400 VAC ± 10%		
Maximum output power	DC	2 x 50kW	
Output voltage		50-500 V	
Output current		2 x 120A	
Efficiency	> 92%		
Power factor	> 0,98		
RFID system	13,56MHz, ISO 14443A		
Communication	CDMA / 3G / Ethernet		
Protection class	IP54		
Temperature range	-30°C … +45 °C, with low-temp option		
Software	Remote update / download		
User interface	High brightness full colour LCD, Start/Stop & Emergency stop		

Use cases in electric vehicle charging
ABB products for the commercial and office use case

Highway
- DC fast charging
- 15-30 minutes

Commercial
- DC & AC charging
- 30-120 min.

Office
- AC & DC charging
- 30-120 min. (fast)
- 8 hours (workday)

Home
- AC & DC charging
- 8 hours (overnight)
- 2 hours (top-off)

Terra SC: the Smart Connection
Cost effective fast charger for office & commercial areas

NEW

Terra SC: the Smart Connection
Cost effective fast charger for office & commercial areas

NEW

- Smart ultra-thin design
- 30-120 minutes charge time
- Can be installed at widely available 3 x 32 A electricity grid connection

Product	Terra SC			
AC Input	3Φ, 400 VAC ± 10%			
Maximum output power	DC	20kW		
Output voltage		180-500 V		
Output current		50A		
Efficiency	93%			
RFID system	13,56MHz, ISO 14443A			
Communication	CDMA / 3G / Ethernet			
Protection class	IP54			
Temperature range	-30°C … +45 °C, with low-temp option			
Software	Remote update / download			
User interface	Full color touch screen			

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Terra SC: the Smart Connection
Highlighted smart features

Smart Access methods for fleets via PIN or RFiD

- Access charger via RFiD cards
- Acces charger via card-less PIN code acces system
- Monitor usage per user

### Monitor usage, energy and calculate CO_2 reduction

- Special Galaxy online management modules for fleet managers & site managers
- Manage access, monitor usage, create graphs
- Configure settings & performance

Optional smart power limiting system

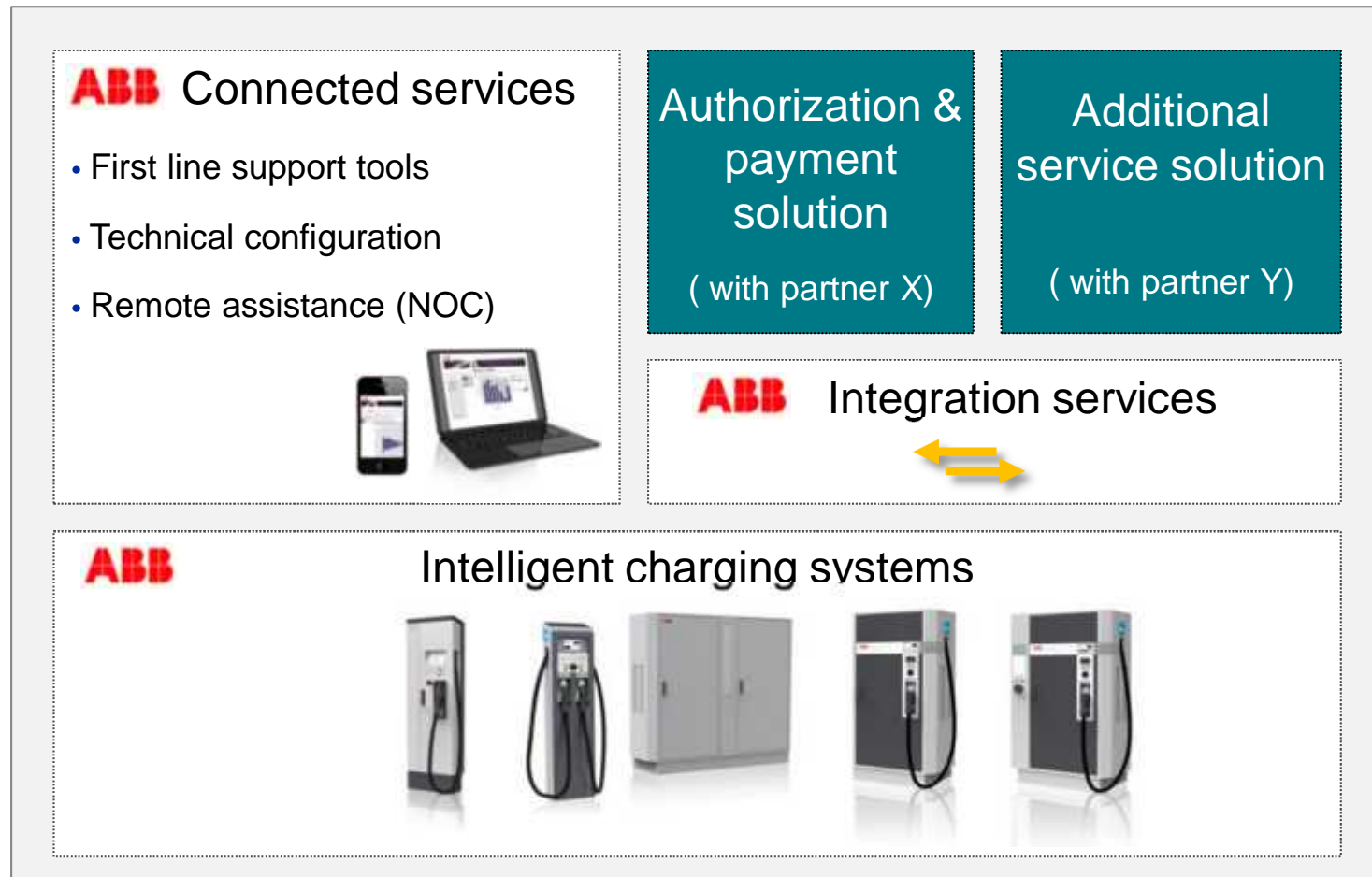- Limiting input power to 3 x 25A or 3 x 20A can help to avoid power peaks & increased installation costs

Connection to back-office & payment systems
Manage, monitor and connect to your business
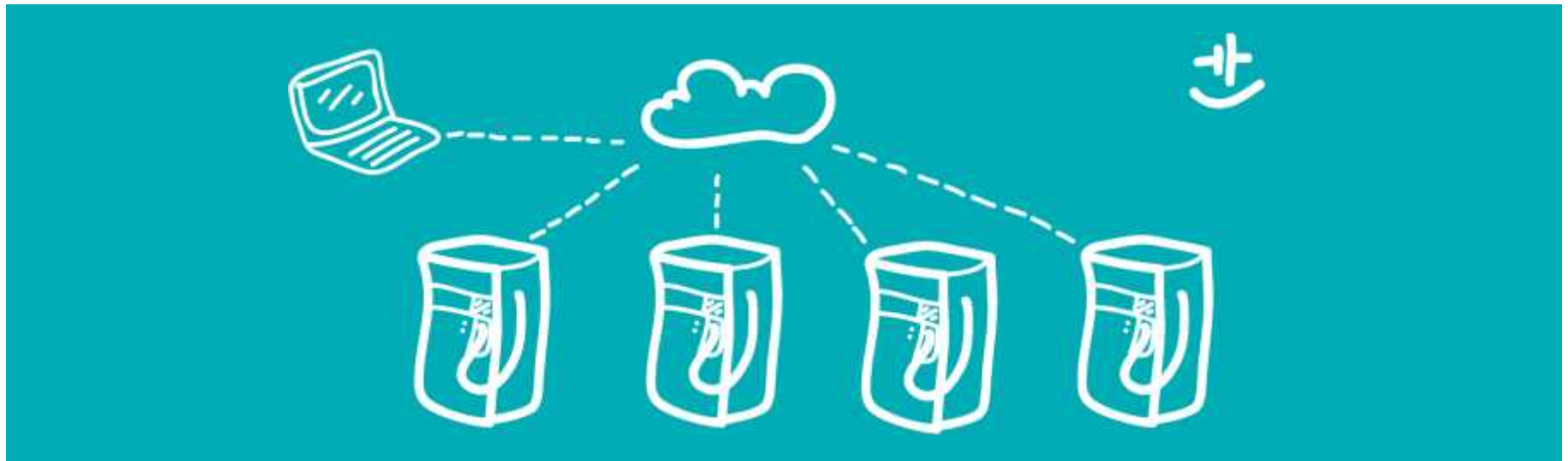
Turn-key software service offering for charging network
# ABB offers complete solutions with partners

ABB Connected services

- First line support tools
- Technical configuration
- Remote assistance (NOC)

Authorization & payment solution

(with partner X)

Additional service solution

(with partner Y)

ABB Integration services

ABB Intelligent charging systems

Data Architecture
Designed for reliability and security

Houston APIs

Your data can be accessed via a Houston API, a reliable server-to-server interface which enables you to connect your own back office or user administration system directly to your charging network.

Data transportation

Your charger data, settings and software updates are transported via a secure connection. ABB uses TLS and X509 certificates, a security standard widely used to protect classified industrial and governmental information.
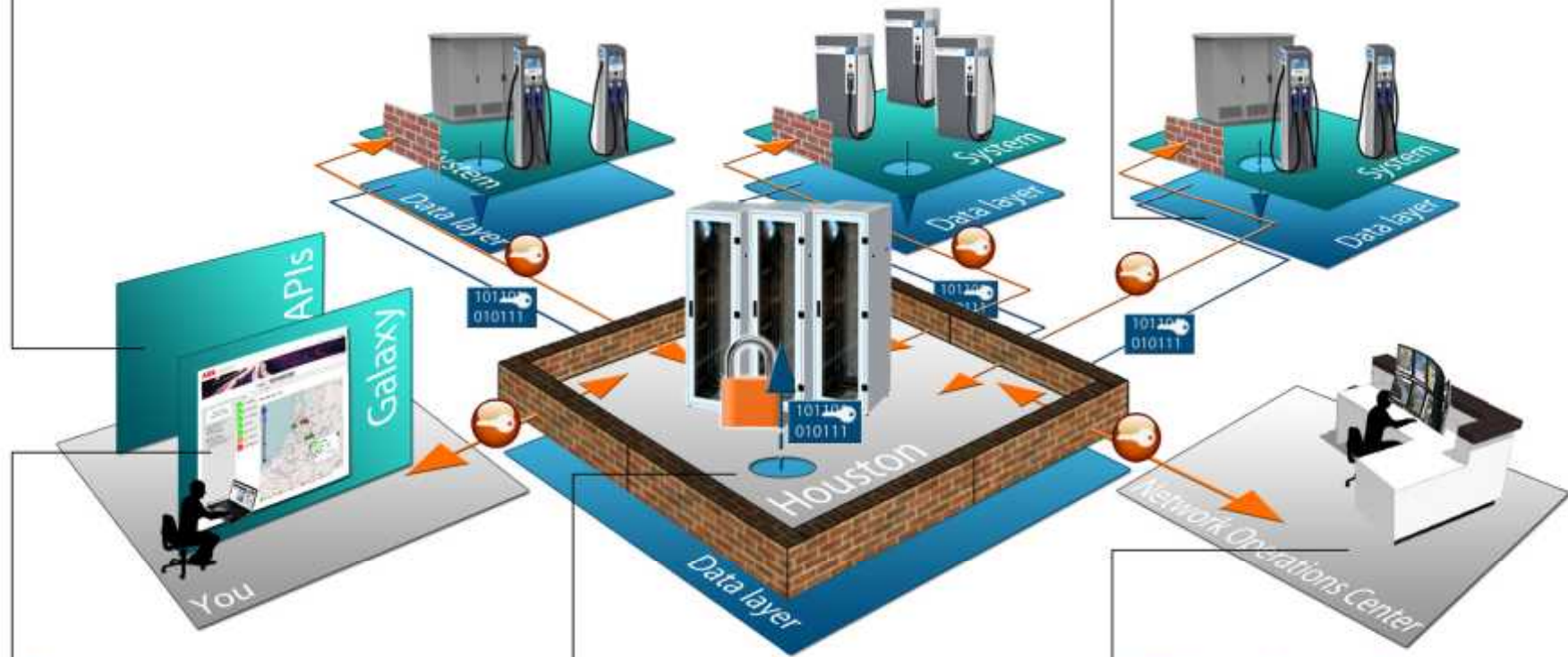
Galaxy

Via your Galaxy web interface you have the ability see real time status, charger usage and energy delivered of your sites and configure the chargers at your sites. Galaxy utilises a secure HTTPS connection to access your data.
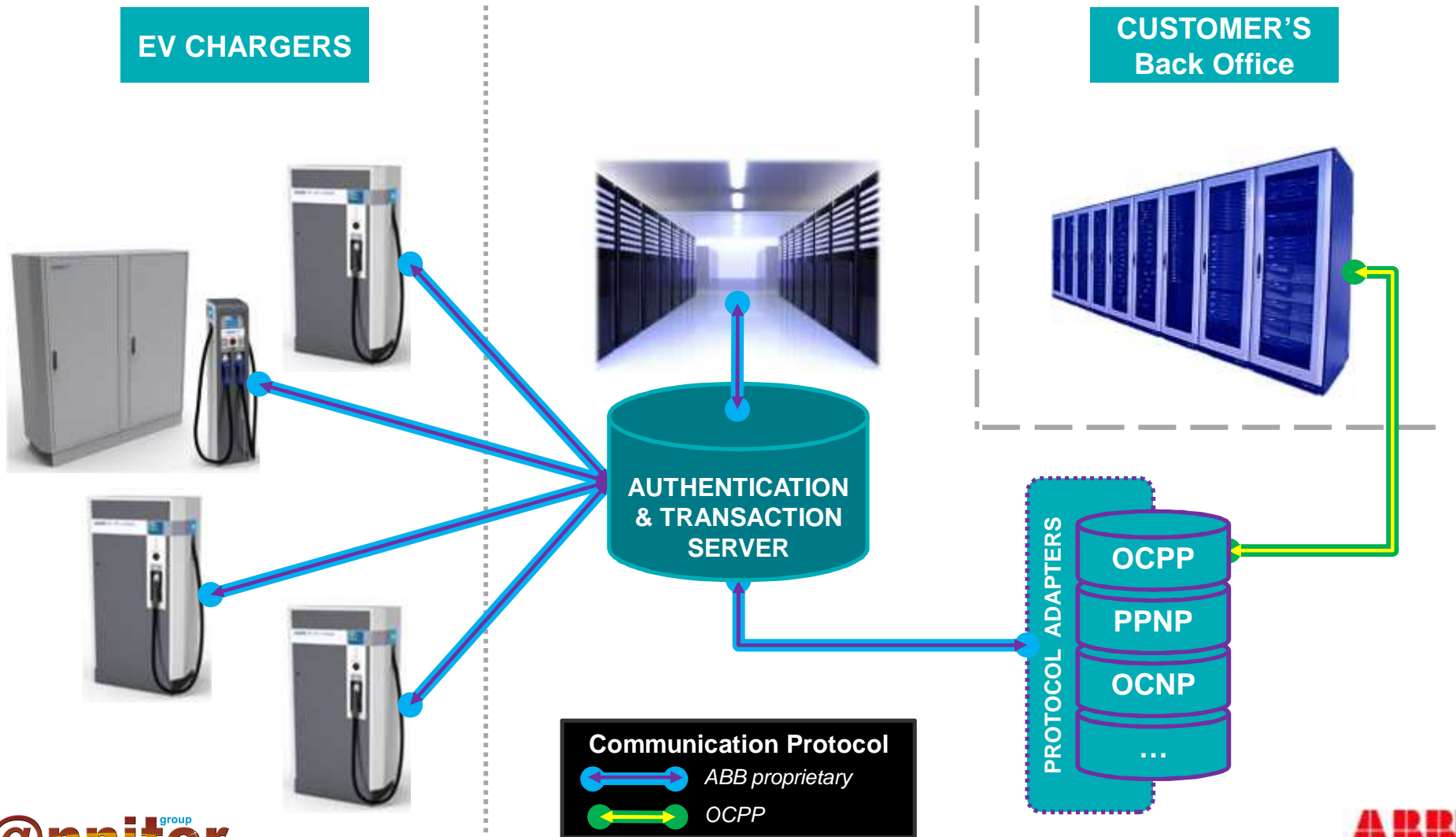
Houston server

Your data is professionally stored at an independent third party data center, utilising strict security standards and professional backup systems. Software updates go via Houston, separated from your data. ABB cannot access your raw data.
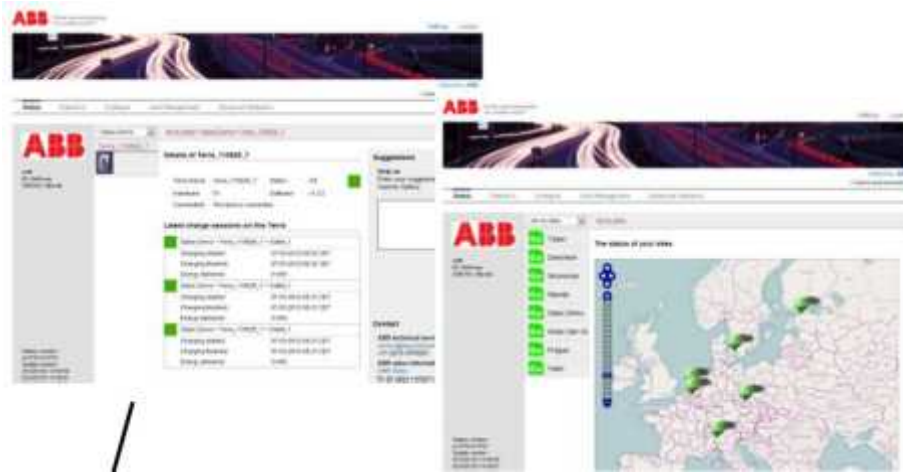
ABB Network Operations Center

The ABB Network Operations Center (NOC) is always stand-by to provide online support and field service assistance. The NOC will keep your software updated and helps you to improve the performance of your operation.

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Back office integration
Basic Architecture

EV CHARGERS

CUSTOMER'S Back Office

AUTHENTICATION & TRANSACTION SERVER

PROTOCOL ADAPTERS

- OCPP
- PPNP
- OCNP
- …

Communication Protocol
- ABB proprietary
- OCPP

Galaxy Software services
Management tool for charging networks & fleets

Modules

- Status module
- Statistics module
- Advanced statistics module
- Configuration module
- RFiD acces module for fleets
- PIN code access module for fleets
- First line support module

Features

- Map view of all chargers
- Usage statistics
- Data per day/week/month/year
- Data per outlet/charger/site
- Manage RFiD acces & PIN code acces
- Data download in Excell (.xls) format
- Configure chargers
- Remote eneable & disable

Modular build-up

- Purchase only the modules you need
- Future proof SAAS solution based on a monthly fee
- Specific packages for basic use, fleet use and several advance options